



isola

B - D E 1 0 4 / 2

DURAVER®-E-Cu
quality 104
quality 104 KF
quality 104 TS

Epoxy fibre glass laminate (FR-4)

Circuit boards for computers, communications systems, industrial electronics and electronic devices in aviation and automotive systems, as well as in measurement and control instrumentation must meet stringent requirements.

Requirements which must be met not only as regards the electrical and mechanical properties, but also in terms of dimensional stability and surface quality.

DURAVER®-E-Cu quality 104, 104 KF and 104 TS are glass reinforced laminates based on epoxy resin and adjusted to absorb UV light. Their mechanical strength – particularly their flexural strength and impact strength – is far greater than that of a phenolic or epoxy paper laminate.

The favourable electrical properties remain constant over a long period of time, even under adverse ambient conditions.

Thermal and chemical stability

DURAVER®-E-Cu quality 104

DURAVER®-E-Cu quality 104 corresponds to NEMA-Quality FR-4 and meets the requirements for flammability class V-0 in accordance with UL 94 (Underwriters' Laboratories, Standard for Safety).

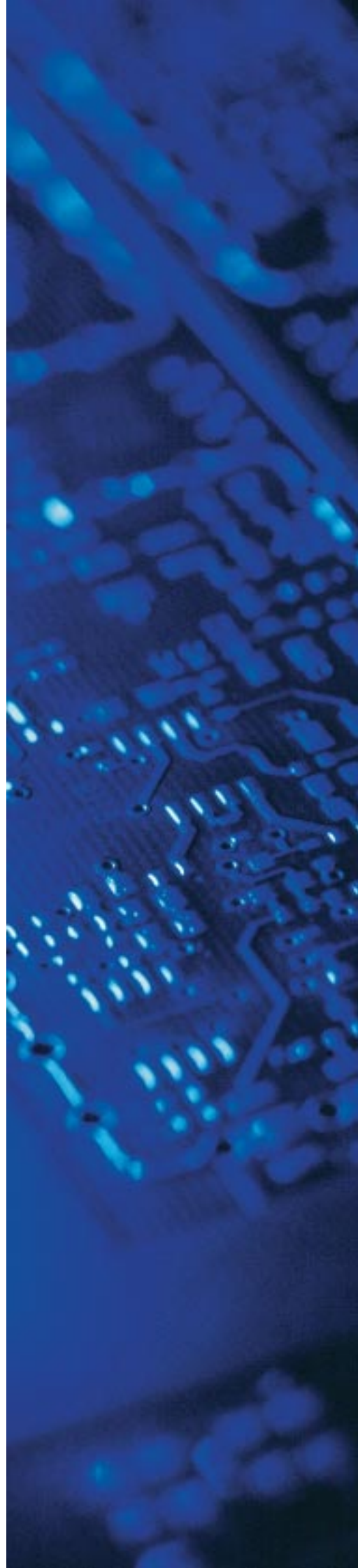
The glass transition temperature (T_g) equals approx. 135 °C. The laminate is pressed under vacuum, thus yielding significant qualitative advantages which cannot be achieved with conventional bonding technology, such as high

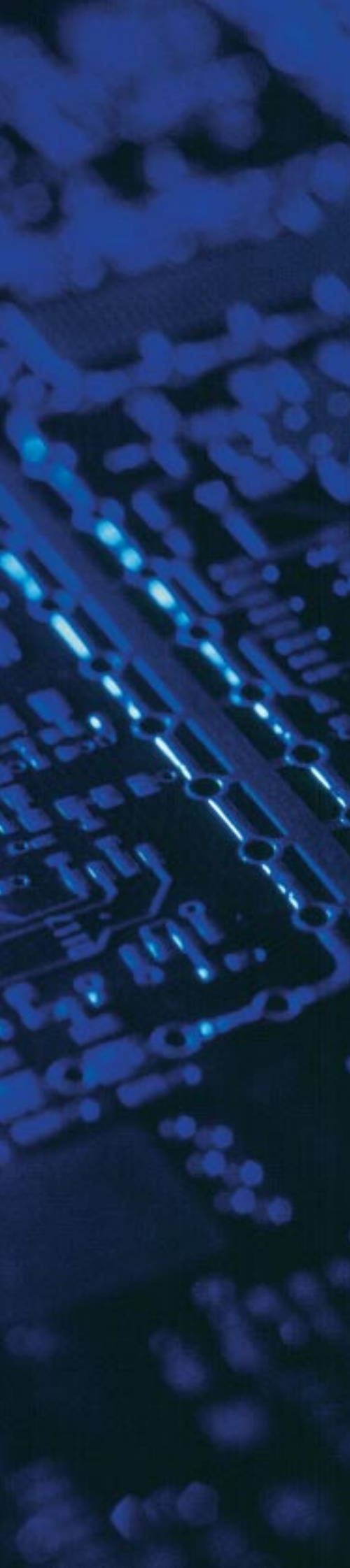
dimensional stability, uniform sheet thickness and little surface ripple. The laminate displays very high thermal and chemical stability.

Laminates of this quality are identified by the manufacturer's code "i". Correspondingly identified qualities are not damaged when processed by conventional methods and the characteristic values of the materials are not impaired by such work.

DURAVER®-E-Cu quality 104 Standard Thickness

Nominal thickness	IPC 4101A		
	Class K	Class L	Class M
mm			
0.80	± 0.165	± 0.100	± 0.075
1.00	± 0.165	± 0.100	± 0.075
1.20	± 0.190	± 0.130	± 0.075
1.50	± 0.190	± 0.130	± 0.075
1.60	± 0.190	± 0.130	± 0.075
2.00	± 0.230	± 0.180	± 0.100
2.40	± 0.230	± 0.180	± 0.100
3.20	± 0.300	± 0.230	± 0.130





track resistant

DURAVER®-E-Cu quality 104 KF

Tracking can easily occur in a damp, dusty or corrosive environment, such as in dishwashers and washing machines. DURAVER®-E-Cu quality 104 KF with high tracking resistance (CTI 400) is available as a special quality for such circuit board applications. In accordance with UL 94 (Underwriters' Laboratories, Standard for Safety) the laminate meets the requirements for flammability class V-0.

Laminates of quality 104 KF are identified with the manufacturer's code "1".

Testing the tracking resistance

In order to obtain a standard for assessing the tracking resistance in accordance with practical requirements, the CTI value (or PTI value for short tests) is determined in accordance with DIN IEC 112.

To test the CTI value, a conductive test solution is applied in droplets between two platinum electrodes 4 mm apart and connected to a variable AC voltage.

The voltage value at which 50 droplets does not produce a creepage current in five specimens is determined. Creepage currents similarly must not occur in five additional specimens exposed to 100 droplets at a voltage 25 V below the first value. The resultant voltage value represents the CTI value, the figure being equal to the test voltage applied. DURAVER®-E-Cu quality 104 KF passes the CTI test at an AC voltage of 400 V.

For the short PTI test, an agreed number of specimens must withstand 50 droplets at only one voltage.

DURAVER®-E-Cu quality 104 KF Standard Thickness

Nominal thickness	IPC 4101A		
	Class K	Class L	Class M
mm			
1.00	± 0.165	± 0.100	± 0.075
1.50	± 0.190	± 0.130	± 0.075
1.60	± 0.190	± 0.130	± 0.075
2.00	± 0.230	± 0.180	± 0.100

heat resistant

DURAVER®-E-Cu quality 104 TS

The requirements imposed with regard to the heat resistance of base materials are also rising constantly. The reasons are due not only to the manufacture of subassemblies, but also to the final use for which the circuit board is required. Soldering processes in particular must be considered critical in the manufacture of subassemblies.

New, leadfree solders with higher melting temperatures will be used in future, with the result that the base material must consequently display greater heat resistance.

In automotive electronic systems, circuit boards are increasingly being positioned in the engine compartment. The intense heat radiated in this area

imposes high thermal stresses on the base material. The material is additionally subjected to thermal shocks here and conventional FR-4 qualitys frequently come up against their load limits in such situations.

With DURAVER®-E-Cu quality 104 TS, Isola has been able to develop a resin formulation with significantly improved thermal stability. In the so-called "T₂₆₀ Test", the time required for delamination at 260 °C is in excess of 60 minutes. A standard FR-4 material is delaminated after only 15 minutes at this temperature.

In all other respects, quality 104 TS displays the same favourable properties as a standard FR-4 quality.



Source: Daimler Chrysler AG/Isola AG

DURAVER®-E-Cu quality 104 TS Standard Thickness

Nominal thickness	IPC 4101A		
	Class K	Class L	Class M
mm			
0.80	± 0.165	± 0.100	± 0.075
1.00	± 0.165	± 0.100	± 0.075
1.20	± 0.190	± 0.130	± 0.075
1.50	± 0.190	± 0.130	± 0.075
1.60	± 0.190	± 0.130	± 0.075
2.00	± 0.230	± 0.180	± 0.100
2.40	± 0.230	± 0.180	± 0.100
3.20	± 0.300	± 0.230	± 0.130

Delivery forms and approvals

Standard sheet sizes

1165 mm x 1070 mm
1225 mm x 925 mm
1225 mm x 1070 mm
1285 mm x 1070 mm

Tolerance: + 3 mm / - 0 mm
Other sizes on request.

Standard copper cladding

18 µm, 35 µm and 70 µm, one-sided or two-sided.
Other thicknesses on request.

Copper foils

Electrodeposited copper foils of maximum purity (at least 98.8 %) are used exclusively. These foils are treated on the side in contact with the base material in order to guarantee optimum adhesion.

Approvals

Underwriters' Laboratories Inc. (UL)
File No. E41625

Panels

Panels are supplied cut to specifications, on request also with mechanically profiled edges and rounded corners.

Tolerances: $\leq 300 \text{ mm} \pm 0.5 \text{ mm}$
 $> 300 \text{ mm} \pm 0.8 \text{ mm}$

Angular deviation:
 $\pm 0.40 \text{ mm}/100 \text{ mm}$ edge length

$\pm 0.15 \text{ mm}/100 \text{ mm}$ edge length
for profiled edges

Various forms of identification are also available, such as laser marking, embossing or ink-jet printing (also as barcode). Pre-cut panels greatly improve the logistics and also reduce the risk of damage to the surface.

Technical data

DURAVER®-E-Cu quality 104, -104 KF, -104 TS

Specification Sheet #:	IPC-4101A/21
Reinforcement:	Woven E-glass
Resin system:	Primary: Difunctional Epoxy • Secondary: Multifunctional Epoxy
Flame Retardant Mechanism:	Bromine • Minimum UL 94 Requirement: V-1
Fillers:	inorganic filler in DE 104 KF
ID Reference:	UL/ANSI: FR-4 • ANSI: FR-4/21
Glass Transition (T _g):	110 °C - 150 °C

Explanations:

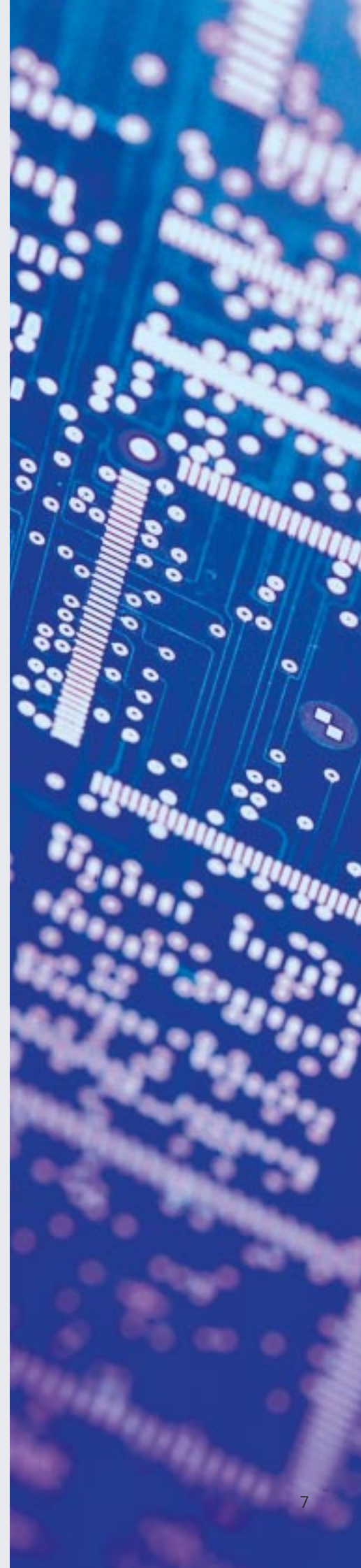
C = preconditioning in humidity chamber
E = preconditioning at temperature

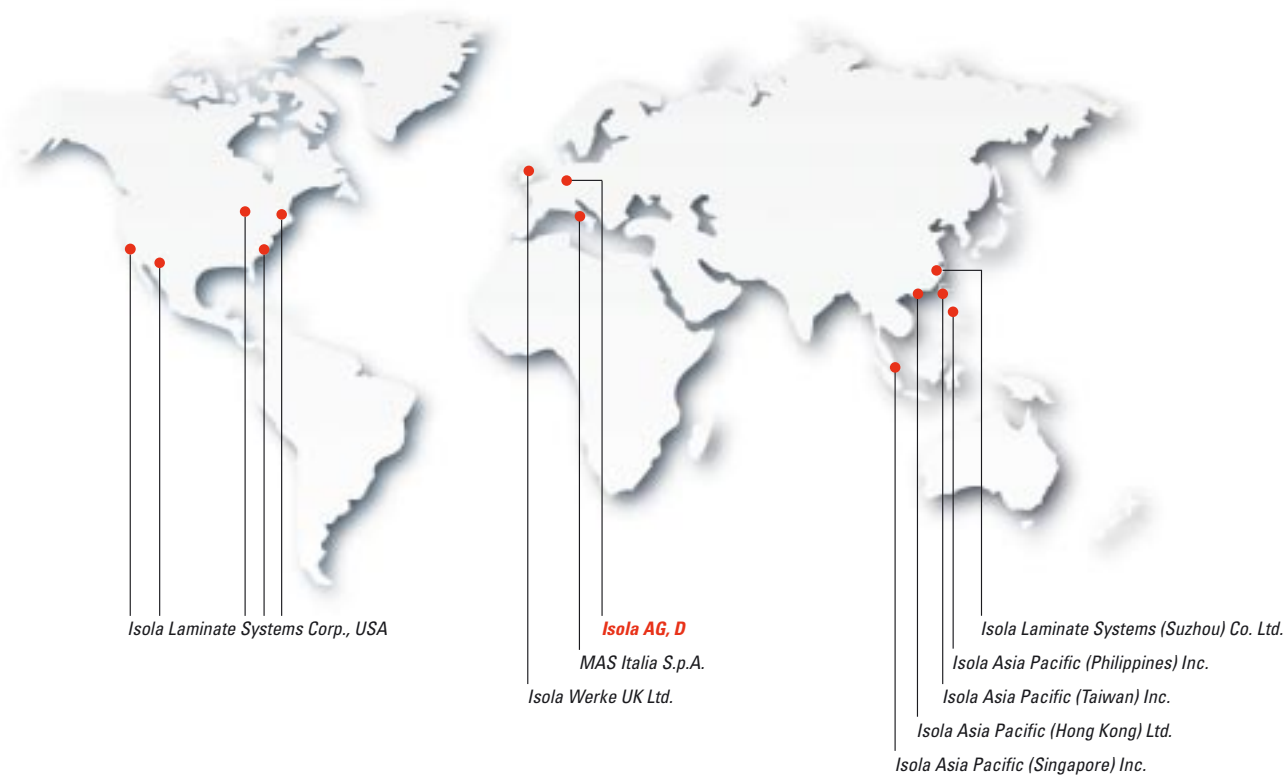
The figures following the letter symbols indicate with the first digit the duration of the preconditioning in hours, with the second digit the preconditioning temperature in °C and with the third digit the relative humidity.

Properties	Unit	Specification
		Laminate thickness ≥ 0.50 mm
1. Peel Strength , minimum		
A. Low profile copper foil and very low profile copper foil - all copper weights > 17 µm	N/mm	0.70
B. Standard profile copper foil (35 µm)		
1. After thermal stress	N/mm	1.05
2. At 125 °C	N/mm	0.70
3. After process solutions	N/mm	0.80
C. All other foil-composite	N/mm	–
2. Volume Resistivity , minimum		
A. C-96/35/90	MΩ · cm	–
B. After moisture resistance	MΩ · cm	1.0 · 10 ⁶
C. At elevated temperature E-24/125	MΩ · cm	1.0 · 10 ³
3. Surface Resistivity , minimum		
A. C-96/35/90	MΩ	–
B. After moisture resistance	MΩ	1.0 · 10 ⁴
C. At elevated temperature E-24/125	MΩ	1.0 · 10 ³
4. Moisture Absorption , maximum		
5. Dielectric Breakdown , minimum		
6. Permittivity @ 1 MHz , maximum		
7. Loss Tangent @ 1 MHz , maximum		
8. Flexural Strength , minimum		
A. Length direction	N/mm ²	415
B. Cross direction	N/mm ²	345
9. Flexural Strength @ Elevated Temperature length direction, minimum	N/mm ²	–
10. Thermal Stress @ 288 °C , minimum		
A. Unetched	s	≥ 10
B. Etched	s	≥ 10
11. Electric Strength , minimum	kV/mm	–
12. Flammability		
A. Average burn time, maximum	s	5
B. Individual burn time, maximum	s	10
13. Glass Transition Temperature (T_g) DSC	°C	–
14. Coefficient of Thermal Expansion (α) TMA		
Weft direction (below T _g /above T _g)	ppm/K	–
Warp direction (below T _g /above T _g)	ppm/K	–
Vertical (below T _g /above T _g)	ppm/K	–

All of this Technical Information has been determined with due care and thoroughness. However, because the conditions of use and the process and application technologies employed can vary so greatly, the provided data and figures can only serve as nonbinding guidelines. They do not constitute a guarantee that the purchased item will possess certain attributes. For this reason, no liability whatsoever can be assumed for them. The buyer is obliged to check the suitability of all supplied products.

Quality 104 Isola-Value	Quality 104 KF Isola-Value	Quality 104 TS Isola-Value	Unit
Laminate thickness ≥ 0.50 mm	Laminate thickness ≥ 0.50 mm	Laminate thickness ≥ 0.50 mm	
–	–	–	N/mm
2.00	1.80	1.40	N/mm
1.90	1.60	1.20	N/mm
2.00	1.80	1.35	N/mm
–	–	–	N/mm
–	–	–	M Ω · cm
$8.0 \cdot 10^8$	$8.2 \cdot 10^8$	$6.8 \cdot 10^7$	M Ω · cm
$8.0 \cdot 10^6$	$7.9 \cdot 10^6$	$9.9 \cdot 10^6$	M Ω · cm
–	–	–	M Ω
$4.0 \cdot 10^6$	$4.1 \cdot 10^6$	$3.4 \cdot 10^6$	M Ω
$7.0 \cdot 10^4$	$3.5 \cdot 10^4$	$1.5 \cdot 10^6$	M Ω
≤ 0.80	≤ 0.80	≤ 0.80	%
45	45	42	kV
4.6 - 4.9	4.6 - 4.9	4.6 - 4.9	
0.019	0.020	0.021	
600	580	550	N/mm ²
480	460	450	N/mm ²
–	–	–	N/mm ²
≥ 10	≥ 10	≥ 10	s
≥ 10	≥ 10	≥ 10	s
–	–	–	kV/mm
3	4	3	s
6	6	6	s
135	135	135	°C
16/14	16/14	16/14	ppm/K
13/7	13/7	13/7	ppm/K
70/280	70/280	70/280	ppm/K





ASIA

Isola Asia Pacific (Hong Kong) Ltd.

Unit 2508-18, Tower 1, Metroplaza
 223 Hing Fong Road, Kwai Chung, N.T., Hong Kong
 Phone: +8 52 / 24 18 - 13 18
 Fax: +8 52 / 24 18 - 15 33
 E-mail: info-hkg@isolaAG.com
 Internet: www.isolaAG.com

EUROPE

Isola AG

52348 Düren
 Germany
 Phone: +49 (0) 24 21/ 80 80
 Fax: +49 (0) 24 21/ 80 81 64
 E-mail: europe@isolaAG.com
 Internet: www.isolaAG.com

USA

Isola Laminate Systems Corp.

230 North Front Street
 La Crosse, WI 54601, USA
 Phone: +1 6 08 / 7 84 - 60 70
 Fax: +1 6 08 / 7 84 - 77 53
 E-mail: usa@isolaAG.com
 Internet: www.isolaAG.com

08/02 - 09112046